a database comprising lattice cell data for materials with known lattice structures;

first computer search means responsive to said electronic signal analyzer data signal outputs for automatically searching said database using a converse transformation method to generate matrices H identifying all database materials, if any, having lattice cell structures related to cell Z; and

computer means for analyzing any matrices H generated by said first search means to identify which of the database materials identified by the generated matrices H match cell Z by having a lattice cell structure identical to or in a subcell/supercell derivative relationship to cell Z, any database material so identified as matching cell Z constituting a possible identification of the unknown crystalline material.

2. The apparatus of claim 1 wherein the materials with known lattice structures have chemical compositions, and said database further comprises element type data identifying the chemical compositions of the materials with known lattice structures, and said apparatus further comprises:

means for determining the element types identifying the chemical compositions of the unknown material and producing electrical signal outputs indicative of the unknown material element types;

second computer search means responsive to the electrical signal outputs produced by said element type determining means for automatically searching said database for all database materials, if any, which match the unknown material by having the same or related element types as the unknown material;

a computer accessible second memory for saving as a first data set the database materials matching cell Z identified by said matrix H analyzing means, and as a second data set the matching database materials with the same element types as the unknown material identified by said second search means; and

said computer means includes means for combining said first and second data sets stored in said second memory to derive all known database materials having the same lattice cell structure and element types as the unknown material.

3. The apparatus of claim 2 wherein said means for determining element types comprises an energy dispersive X-ray spectrometer.

4. The apparatus of claim 1 wherein:

said computer analyzing means includes means for determining derivative subcells and supercells of said cell Z; and

said first computer search means includes means for performing a first search of said database without generating said matrices H to identify all database materials which match said cell Z with respect to cell edges, a second search of said database without generating said matrices H to identify all database materials which match said derivative subcells or supercells with respect to cell edges, and a third search of the database materials identified by said first and second searches using said converse transformation method to generate matrices H identifying those database materials which match cell Z with respect to both cell edges and cell angles.

5. The apparatus of claim 4 wherein:

said database comprises lattice cell data in a reduced form;

said electronic signal analyzer produces electrical data signal outputs corresponding to a reduced form of said cell Z; and

said computer analyzing means determines the derivative subcells and supercells in a reduced form.

6. Apparatus for analyzing electrical signals, derived from radiation signals received from an irradiated sample of an unknown crystalline material, said electrical signals being indicative of a primitive lattice cell Z of the unknown crystalline material, to identify the unknown material, the cell Z having three cell edges ZA, ZB, and ZC, respectively, and three cell angles ZAL, ZBE, and ZGA, respectively, said apparatus comprising:

a first computer accessible memory in which is stored a database comprising lattice cell data for materials with known lattice structures;

first computer search means for evaluating said electrical signals by automatically searching said database using a converse transformation method to generate matrices H identifying all database materials, if any, having lattice cell structures related to cell Z; and

computer means for analyzing any matrices H generated by said first search means to identify which of the generated matrices H match cell Z by having a lattice cell structure identical to or in a subcell/supercell derivative relationship to cell Z, any database material so identified as matching cell Z constituting a possible identification of the unknown crystalline material.

7. Apparatus for analyzing first electrical signals, derived from radiation signals received form an irradiated sample of an unknown crystalline material, said first electrical signals being indicative of a primitive lattice cell Z of the unknown crystalline material, the cell Z having three cell edges ZA, ZB, and ZC, respectively, and three cell angles ZAL, ZBE, and ZGA, respectively, and for analyzing second electrical signals, derived from evaluation of the unknown material, and indicative of the element types identifying the chemical composition of the unknown material, to identify the unknown material, said apparatus comprising:

a first computer accessible memory in which is stored a database comprising lattice cell data for materials with known lattice structures and element type data identifying the chemical compositions of the materials with known lattice structures;

first computer search means for evaluating said first electrical signals by automatically searching said database using a converse transformation method to generate matrices H identifying all database materials, if any, having lattice cell structures related to cell Z;

second computer search means for evaluating said second electrical signals by automatically searching said database for all database materials, if any, which match the unknown material by having the same or related element types as the unknown material;

computer means for analyzing any matrices H generated by said first search means to identify which of the generated matrices H match cell Z by having a lattice cell structure identical to or in a subcell/supercell derivative relationship to cell Z, any database material so identified as matching cell Z constituting a possible identification of the unknown crystalline material;